CASE REPORT

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Impaired Rehabilitation Secondary to Muscle Weakness Induced by Meropenem

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Contents

1. Case Report 1
2. Discussion 2

Meropenem is a broad-spectrum carbapenem that is used extensively in the inpatient setting as treatment for many resistant bacterial infections. Meropenem is a carbapenem antibiotic that belongs to the penicillin derivatives group. Penicillin derivatives are known to cause hypokalaemia by distal delivery of non-reabsorbed anions and increased renal loss of potassium.[1] Hypokalaemia and hypomagnesaemia cause a low (more negative) membrane potential and often present with muscle weakness and fatigue.[1]

In this report, we describe a case of prolonged severe hypokalaemia and hypomagnesaemia induced by meropenem that resulted in chronic muscle weakness and an impaired rehabilitation outcome for the patient.

1. Case Report

A 35-year-old generally healthy (not receiving any medications) Caucasian female patient was admitted to the intensive care unit with an acute onset of severe shortness of breath and fever and was diagnosed with bilateral pneumococcal pneumonia. Her physical examination demonstrated decreased air entry to the lung bases, crepitations, bronchial breathing bilaterally, and high fever (39°C) and chills. A chest x-ray showed right lower lobe (RLL), right middle lobe (RML) and left lower lobe (LLL) consolidations. Blood cultures were positive for pneumococcus, and the patient was administered intravenous meropenem. The patient received supportive care including mechanical ventilation, oxycodone for pain and paracetamol (acetaminophen) for fever, intravenous fluids and electrolytes replacement.

The patient's potassium, magnesium and renal functions were normal on the day of admission. In addition, her muscle strength was 5/5 bilaterally, and a neurological examination was normal on the day of admission.

The patient developed acute respiratory failure 2–3h after admission, and was intubated. She was afebrile and haemodynamically stable while receiving intravenous meropenem. The follow-up basic metabolic profile showed severe hypokalaemia and hypomagnesaemia (potassium 2.5–3 mmol/L, magnesium 1.3–1.5 mmol/L) 3 days after the intravenous meropenem was started. Potassium and magnesium were replaced intravenously, but the hypokalaemia and hypomagnesaemia were persistent. At that point, meropenem therapy was switched to treatment with an intravenous fourth-generation cephalosporin (cefepime), after which the potassium

and magnesium levels normalised without supplementation. Four days after the switch, the patient became febrile and hypotensive, and intravenous meropenem was restarted. However, two days after restarting intravenous meropenem, the patient again developed severe hypokalaemia and hypomagnesaemia. The patient was ventilated through the nasogastric tube for about 2 weeks and then had tracheostome placed. She was administered intravenous fluids and pressors over the first 3 days and was then on supportive care. The pneumococcus was sensitive to both cefepime and meropenem. but clinically she improved on meropenem and not on cefipime.

Although the bilateral pneumonia improved while the patient was receiving meropenem, the patient gradually developed muscle weakness 4+/5 1 week after hospitalisation and 3/5 (full range of motion against gravity only) 2 weeks after hospitalisation, affecting the lower extremities more than the upper. Physical therapy was attempted but failed secondary to the progressive muscle weakness induced by prolonged hypokalaemia and hypomagnesaemia. The patient underwent tracheostomy. The weaning and extubation efforts failed secondary to the progressive muscle weakness until the intravenous meropenem was stopped. After discontinuation of the meropenem, potassium and magnesium levels normalised and muscle strength gradually recovered to pre-admission levels over the next 2 weeks. The patient was HIV and cytomegalovirus negative.

2. Discussion

The majority of penicillin derivatives have been implicated as causes of hypokalaemia by distal delivery of non-reabsorbed anions and increased renal loss of potassium,[2,3] although meropenem has not been reported as an isolated cause of hypokalaemia. Hypokalaemia and hypomagnesaemia are very common in the clinical setting, and it is usually hard to determine the exact cause in a patient with multiple medical problems who is usually receiving a multidrug regimen at the same time.

The combination of alkalosis, hypocalcaemia, hypokalaemia and hypophosphataemia in patients admitted to hospital with bacterial pneumonia signifies that these patients comprise a high risk group of patients.[4,5] In our case, the patient was generally healthy prior to admission, meropenem and cefepime were the only medications given, and the adverse effect was confirmed by rechallenge.

In the intensive care unit, patients are usually managed by medical or surgical services. In our case, the consulting rehabilitation medicine specialist relied on a medical assessment that defined the patient as "medically stable, no acute medical problems and no contraindication for therapy". The decreased muscle strength was erroneously related to deconditioning in this previously healthy individual. A full medical assessment by a rehabilitation medicine specialist and awareness of this phenomenon in order to avoid chronic hypokalaemia and hypomagnesaemia and significantly improve the functional outcome is advocated.

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